

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
13 October 2005 (13.10.2005)

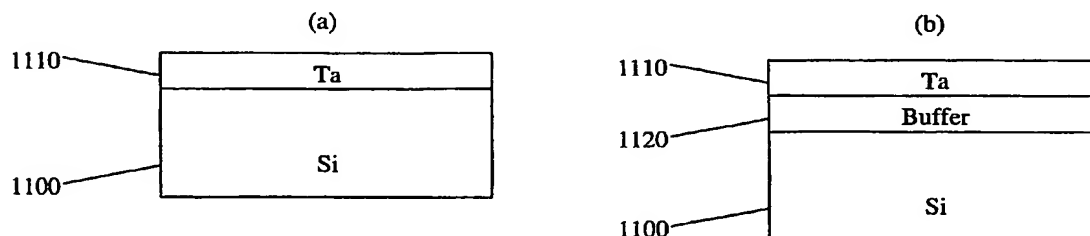
PCT

(10) International Publication Number
WO 2005/095263 A2

- (51) International Patent Classification⁷: **B81C 1/00**, C30B 23/00, 25/00, C23C 14/16, 14/54, C30B 29/02
- (21) International Application Number:
PCT/US2005/009763
- (22) International Filing Date: 24 March 2005 (24.03.2005)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/555,759 24 March 2004 (24.03.2004) US
- (71) Applicant (for all designated States except US): **H. C. STARCK INC.** [US/US]; 45 Industrial Place, Newton, MA 02461 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **NARAYAN, Jagdish** [US/US]; 4917 Springwood Drive, Raleigh, NC 27613 (US). **KUMAR, Prabhat** [US/US]; 31 Pinewood Drive, Framingham, MA 01701 (US). **WU, Richard** [US/US]; 3 Rosemary Lane, Chelmsford, MA 01824 (US).
- (74) Agents: **GIL, Joseph, C. et al.**; Bayer MaterialScience LLC, 100 Bayer Road, Pittsburgh, PA 15205 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
— without international search report and to be republished upon receipt of that report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHODS OF FORMING ALPHA AND BETA TANTALUM FILMS WITH CONTROLLED AND NEW MICROSTRUCTURES

Schematic cross-section view of formation Ta films 1110 on silicon substrate 1100 without buffer (Figure 1(a)) and with buffer layer 1120 (Figure 1(b)).(Narayan)



(57) Abstract: Thin tantalum films having novel microstructures are provided. The films have microstructures such as nanocrystalline, single crystal and amorphous. These films provide excellent diffusion barrier properties and are useful in microelectronic devices. Methods of forming the films using pulsed laser deposition (PLD) and molecular beam epitaxy (MBE) deposition methods are also provided, as are microelectronic devices incorporating these films.